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1. An infinitely-variable transmission comprising:
a rotational input member, and a rotational output member;
a pair of variable velocity-ratio gear sets;
a multi-directional coupling associated with the gear sets;
an actuator associated with the coupling for coupling the gear sets to the rotational members over a common angular period for providing a uniform velocity ratio between the rotational members over the angular period; and
a phase angle variator associated with at least one of the gear sets for varying a rotational angular displacement between the gear sets for varying the uniform velocity ratio.

2. The transmission according to claim 1, wherein at least one of the gear sets has a constant contact ratio.

3. The transmission according to claim 1, the actuator comprises a pair of shadow cams coupled to one of the rotational members, each of the shadow cams being synchronized with a respective one of the gear sets for altering a coupling state of the coupling.

4. The transmission according to claim 3, wherein at least one of the shadow cams includes a lobe for coupling the respective gear set to the rotational members within the angular period.

5. The transmission according to claim 3, wherein the shadow cams comprise a pair of bearing races, and a bearing communicating with the races, each said bearing race including a race portion for coupling the respective gear set to the rotational members within the angular period.

6. The transmission according to claim 3, wherein the shadow cams comprise a pair of bearing half-races, the half-races together comprising a common race, and a bearing disposed within the common race, each said bearing half-race including a race portion for coupling the respective gear set to the rotational members within the angular period.

7. The transmission according to claim 3, wherein the shadows cams comprise a pair of actuator gears coupled to one of the rotational members, each said actuator gear including a riser portion for coupling the respective gear set to the rotational members within the angular period.

8. The transmission according to claim 1, wherein each said variable-ratio gear set provides an interval of uniform acceleration and an interval of non-uniform acceleration, and the angular period comprises an angular interval of the uniform acceleration common to both of the gear sets.

9. The transmission according to claim 1, wherein each said variable-ratio gear set comprises a pair of meshing non-circular gears, each said non-circular gear including a linear pitch circle portion and a non-linear pitch circle portion, and the angular period coincides with an interval of the linear pitch circle portions common to both of the gear sets.

10. The transmission according to claim 1, wherein the phase angle variator comprises a stator coupled to one of rotational members, and a rotor provided within the stator and being coupled to the other of the rotational members.

11. The transmission according to claim 10, wherein the stator includes an aperture for receiving pressurized fluid for displacing the rotor axially within the stator, and a plurality of spiral passages, and

the rotor includes pressurized fluid ingress and egress ports for communication with the spiral passages for rotating the rotor as the rotor is axially displaced.

12. The transmission according to claim 1, wherein the phase angle variator comprises a spring coupled between the rotational members for varying the angular displacement in response to output load.

13. The transmission according to claim 1, wherein the phase angle variator comprises a differential including a first bevel gear coupled to one of the rotational members, a manually-operated second bevel gear coupled to the other of the rotational members, and a pinion coupled to the bevel gears.

14. The transmission according to claim 1, wherein the phase angle variator comprises a first actuator gear coupled to one of the rotational members, a second actuator gear coupled to the other of the rotational members, a cage rotatable about the actuator gears and including a spool rotatably coupled to the cage, the spool retaining a first spool gear thereon meshing with the first actuator gear, a second spool gear thereon meshing with the second actuator gear, the first spool gear being coupled to the second spool gear for rotation therewith and having a diameter different from that of the second spool gear, and a brake for selectively preventing rotation of the cage.

15. The transmission according to claim 14, wherein the phase angle variator further comprises a clutch coupled to the cage for selectively preventing rotation of the cage relative to the rotational members.

16. The transmission according to claim 1, wherein the multi-directional coupling comprises:

a race including a first tubular friction surface,

a tubular member including a first bearing surface,

a tubular slipper including a second tubular friction for coupling to the first tubular friction surface, and a second bearing surface opposite the second friction surface, the second bearing surface being coaxial to the first bearing surface and, together with the first bearing surface, defining a channel disposed therebetween, and

a plurality of roller elements disposed in the channel in abutment against the bearing surfaces, the channel including a pocket retaining at least one of the roller elements therein for coupling the race to the tubular member as the tubular member and the slipper rotate relative to one another;

and the actuator is configured to prevent rotational movement of the slipper relative to the tubular member over the angular period.

17. The transmission according to claim 16, wherein the first friction surface comprises a conical friction surface, the second tubular friction surface being shaped to mate with the conical friction surface, and the actuator includes an actuator ring for moving the slipper axially relative to the race for altering a coupling state of the coupling.

18. The transmission according to claim 16, wherein the first friction surface comprises a conical friction surface, the second tubular friction surface being shaped to mate with the conical friction surface, and the actuator includes an actuator ring for moving the race axially relative to the slipper for altering a coupling state of the coupling.

19. The transmission according to claim 1, wherein the variable velocity-ratio gear sets are coupled to one of rotational members, and the transmission includes a torque-splitter coupled to the other of the rotational members for conveying torque between the gear sets and the other rotational member.

20. The transmission according to claim 19, wherein the torque-splitter comprises a differential, the differential including a pair of bevel gears, a cage, and a pinion rotatably coupled to the cage and meshing with the bevel gears.

21. The transmission according to claim 20, wherein the cage is coupled to one of the variable-ratio gear sets, a first of the bevel gears is coupled to the other of the variable-ratio gear sets, and a second of the bevel gears is coupled to the one rotational member.

22. The transmission according to claim 20, where a first of the bevel gears is coupled to one of the variable-ratio gear sets, a second of the bevel gears is coupled to the other of the variable-ratio gear sets, and the cage is coupled to the one rotational member.

23. The transmission according to claim 19, wherein the torque splitter comprises a planetary gear assembly.

24. The transmission according to claim 19, wherein the torque splitter comprises a coplanar reverted gear-train loop, the coplanar reverted gear-train loop including a pinion, an annular internal gear disposed around the pinion and being coaxial thereto, and a cage assembly comprising a ring gear including an inner surface engaging the pinion and an outer surface engaging the annular gear, the cage assembly further comprising an eccentric guide for disposing the ring gear coplanar to and eccentrically with respect to the pinion and the annular gear.

25. An all-gear transmission comprising:

a rotational input member, and a rotational output member;

a pair of variable velocity-ratio gear sets, the velocity-ratios being phased through a rotational phase angle;

a multi-directional coupling associated with the gear sets; and

an actuator associated with the coupling for coupling the gear sets to the rotational members over a common angular period for providing a uniform velocity ratio between the rotational members over the angular period, the uniform velocity ratio being dependent upon the rotational phase angle.

26. An infinitely-variable transmission comprising:

a rotational input member;

a rotational output member;

a pair of non-circular driving gears coupled to one of the rotational members; and

a plurality of variable velocity-ratio gear assemblies disposed about the one rotational member, and being coupled to the non-circular gears and the other of the rotational members for providing a uniform velocity ratio between the rotational members over a rotational period, each said variable velocity-ratio gear assembly comprising:

an intermediate shaft including a pair of non-circular driven gears meshing with the non-circular driving gears, one of the driving gears and the associated driven gear comprising a first variable-ratio gear pair, and the other of the driving gears and the associated driven gear comprising a second variable-ratio gear pair;

a multi-directional coupling associated with the variable-ratio gear pairs; and

an actuator associated with the coupling for coupling the variable-ratio gear pairs to the rotational members over an angular period for providing the uniform velocity ratio between the rotational members over the angular period, the angular periods for the variable velocity-ratio gear assemblies together comprising the rotational period; and

a phase angle variator associated with the variable-ratio gear pairs for varying a rotational angular displacement between the first gear pairs and the second gear pairs for varying the uniform velocity ratio.

27. An actuator for transmitting power between a pair of rotational drive members over an angular portion of a revolution of one of the drive members, a first of the drive members including a drive element and a second of the drive members including a driven element, the actuator comprising:

an intermediate rotational member;

a first intermediate drive element meshing with the driving element;

a second intermediate drive element meshing with the driven element, one of the intermediate drive elements being rotatably coupled to the intermediate member and the other of the intermediate drive elements being fixed to the intermediate member;

a coupling coupled between the intermediate member and the one intermediate drive element; and

a cam coupled to the one drive member and the coupling for altering a coupling state of the coupling.

28. The actuator according to claim 27, wherein the multi-directional coupling comprises:

a race including a first tubular friction surface,

a tubular member including a first bearing surface,

a tubular slipper including a second tubular friction for coupling to the first tubular friction surface, and a second bearing surface opposite the second friction surface, the second bearing surface being coaxial to the first bearing surface and, together with the first bearing surface, defining a channel disposed therebetween, and

a plurality of roller elements disposed in the channel in abutment against the bearing surfaces, the channel including a pocket retaining at least one of the roller elements therein for coupling the race to the tubular member as the tubular member and the slipper rotate relative to one another.

29. The actuator according to claim 28, wherein the first friction surface comprises a conical friction surface, the second tubular friction surface being shaped to mate with the conical friction surface, and the cam comprises a shadow cam including a lobe for pressing the race against the slipper over the angular portion.

30. The actuator according to claim 28, wherein the first friction surface comprises a conical friction surface, the second tubular friction surface being shaped to mate with the conical friction surface, and the cam comprises a bearing race, and a bearing in communicating with the bearing race, the bearing race including a race portion for pressing the coupling race against the slipper over the angular portion.

31. The actuator according to claim 28, wherein the first friction surface comprises a conical friction surface, the second tubular friction surface being shaped to mate with the conical friction surface, and the cam comprises a gear including an axially-extending riser portion for pressing the race against the slipper over the angular portion.

32. A method for defining tooth flanks on pairs of meshing non-circular gears. comprising the steps of:

determining a pitch locus for one of the non-circular gears;

segmenting the pitch locus into pitch locus portions;

determining an effective pitch circle locus for the pitch locus portions by projecting the pitch locus portions onto a centre line joining centres of the non-circular gears;

determining an effective generating circle locus for the effective pitch circle locus, the effective generating circle locus being determined in accordance with a desired pressure angle between the non-circular gears; and

determining a locus of congruency for the gears from the effective generating circle locus.

33. The method according to claim 32, wherein the step of determining the effective pitch circle locus comprises defining a plurality of pitch circle points on the pitch locus portion, and rotating the pitch circle points about the centre of the one non-circular gear.

34. The method according to claim 33, wherein the step of determining the effective generating circle locus comprises determining an arc length distance along the pitch locus portion between the centre line and each said defined pitch circle point, and projecting the respective rotated pitch circle points the respective arc length distance along a respective line in accordance with a desired line of action between the gears.

35. The method according to claim 34, wherein the step of determining the locus of congruency comprises determining an angular displacement of the defined pitch circle points relative to the centre line, and rotating the projected pitch circle points the respective angular displacements about the centres of the gears.